DRAFT

DOE/EA-1319

Environmental Assessment

Disposition of Surplus Hanford Site Uranium, Hanford Site, Richland, Washington

U.S. Department of Energy
Richland Operations Office
Richland, Washington 99352

November 1999

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Department of Energy
Richland Operations Office
P.O. Box 550
Richland, Washington 99352

DEC 16 1999

99-TPD-330

Addressees - See Attached

DRAFT ENVIRONMENTAL ASSESSMENT (EA), DISPOSITION OF SURPLUS HANFORD SITE URANIUM, HANFORD SITE, RICHLAND, WASHINGTON

In accordance with the U.S. Department of Energy's National Environmental Policy Act (NEPA) regulations and per my previous notification letter, the draft Richland Operations Office (RL) Environmental Assessment (EA), Disposition of Surplus Hanford Site Uranium, is enclosed for your review prior to finalization. The public review period will run for 35 calendar days from the date of this letter.

Additional copies of the draft EA are available at the Richland DOE Public Reading Room located at 2770 University Drive, Room 101L, in Richland, Washington 99352. The Reading Room website is located at internet address http://www.hanford.gov/doe/reading.htm. The Richland Reading Room may be contacted by telephone at (509) 372-7443, by facsimile at (509) 372-7444, or by e-mail at doe.reading.room@pnl.gov.

The draft EA is also available for your review at the Oak Ridge DOE Public Reading Room in both electronic and hard copy formats. Oak Ridge website access to this RL draft EA is available at internet address http://www.oakridge.doe.gov/Foia/DOE_Public_Reading_Room.htm. Hard copy acquisition or review of the document can be performed at the Reading Room's location at 230 Warehouse Road, Suite 300, at the east end of the City of Oak Ridge, Tennessee. Inquiries for acquisition or review of the RL draft EA within the Oak Ridge vicinity may be sent to the Public Reading Room at telephone (423) 241-4780, or facsimile (423) 574-3521. Written requests can also be sent to the Oak Ridge Reading Room at:

U.S. Department of Energy
Oak Ridge Operations office
P.O. Box 2001
200 Administration Road, Room B-112
Oak Ridge, Tennessee 37830

Please direct any questions or comments on the draft EA for this proposed action to Angel B. Joy, Materials Disposition Division, (509) 373-7834. Questions about the NEPA process may be directed to me on (509) 376-6667.

Questions and comments may be sent to:

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Sincerely,

Paul F. X. Dunigan, Jr.

Paul F. X. Dunigan, Jr.
NEPA Compliance Officer

MDD:ABJ

Enclosure

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GLOSSARY

Acronyms and Initialisms

ALARA	as low as reasonably achievable
CFR	Code of Federal Regulations
CY	calendar year
DOE	U.S. Department of Energy
DOT	U.S. Department of Transportation
DU	depleted uranium
EA	environmental assessment
EIS	environmental impact statement
ERPG	emergency response planning guidelines
FEMP	Fernald Environmental Management Project
FR	Federal Register
IAEA	International Atomic Energy Agency
ISO	International Standards Organizations
LCF	latent cancer fatality
LEU	low-enriched uranium
LSA	low specific activity
MTU	metric tons of uranium
NCRP	National Council on Radiation Protection and Measurements
NEPA	*National Environmental Policy Act of 1969*
PNNL	Pacific Northwest National Laboratory
ROD	Record of Decision
SCAPA	Subcommittee on Consequence Assessment and Protective Actions
TEDE	total effective dose equivalent
TEEL	temporary emergency exposure limit
UU	unirradiated uranium
WAC	Washington Administrative Code
WDOH	Washington State Department of Health
WHC	Westinghouse Hanford Company

Definition of Terms

as low as reasonably achievable (ALARA). An approach to radiation protection to control or manage exposures (both individual and collective to the workforce and general public) as low as social, technical, economic, practical, and public policy considerations permit.

Background radiation. That level of radioactivity from naturally occurring sources; principally radiation from cosmogenic and primordial radionuclides.

Decay, radioactive. A spontaneous nuclear transformation of one nuclide into a different nuclide or into a different energy state of the same nuclide by emission of particles and/or photons.

Depleted uranium. Uranium having less than 0.711 as the percentage by weight of uranium-235 (i.e., assay less than natural uranium).

Enrichment. The isotopic content, by weight, of uranium-235 in the total mass of uranium.

Fissile. Material capable of undergoing fission by slow neutrons.

Latent cancer fatality. The excess cancer fatalities in a population due to exposure to a carcinogen.

Low-enriched Uranium. Uranium having between 0.711 weight percent and 20 weight percent of uranium-235.

Low Specific Activity (LSA). A shipping category designation based on U.S. Department of Transportation requirements specified in 49 CFR 173-403. LSA material is a DOE class 7 (radioactive material) comprised of limited specific activity radioactive materials. Specific activity limits for the LSA material category are specified in three different subcategories (i.e., LSA I, LSA II, or LSA III), which are explicitly related to the quantity of material involved.

Maximally exposed individual. A hypothetical member of the public who, by virtue of location and living habits, could receive the highest possible exposure to radiation or to hazardous materials as a result of routine operations or accidental events.

Natural uranium. Uranium in its pre-enriched state, as found in nature, having a uranium 235 concentration of approximately 0.7 percent.

Normal uranium. Uranium having approximately 0.7 as the percentage by weight of uranium-235 as occurring in nature, but created by a synthetic process.

Package. For radioactive materials, the packaging together with its radioactive contents as presented for transport. The specific requirements are found in 49 CFR 173, "Shippers-General Requirements for Shipments and Packaging."

Packaging. For radioactive materials, the assembly of components necessary to ensure compliance with the packaging requirements. Packaging could consist of one or more receptacles, sorbent materials, spacing structures, thermal insulation, radiation shielding, and devices for cooling or sorbing mechanical shocks. The conveyance, tie-down system, and auxiliary equipment sometimes could be designated as part of the packaging. The specific requirements are found in 49 CFR 173, "Shippers-General Requirements for Shipments and Packaging".

Person-rem. The unit of collective dose to a population based on the number of exposed individuals multiplied by the radiation dose to each individual.

rem. The conventional unit of equivalent dose.

Risk. The product of the probability of occurrence of an accident and the consequences of an accident.

Total effective dose equivalent. The sum of the effective dose equivalent (for external exposures) and the committed effective dose equivalent (for internal exposures). A measure of radiation dose related to risk of long-term health effects (i.e., latent cancers and genetic effects) following exposure to ionizing radiation.

METRIC CONVERSION CHART

If you know	Multiply by	To get
Length		
centimeters	0.39	inches
meters	3.28	feet
kilometers	0.54	nautical miles
kilometers	0.62	statute miles
Area		
square kilometers	0.39	square miles
Mass (weight)		
grams	0.035	ounces
kilograms	2.2	pounds
kilograms	0.001	metric tons
Volume		
liters	0.264	gallons
cubic meters	35.32	cubic feet

Source: CRC Handbook of Chemistry and Physics, Robert C. Weast, Ph.D., 70th Ed., 1989-1990, CRC Press, Inc., Boca Raton, Florida.

SCIENTIFIC NOTATION CONVERSION CHART

Multiplier	Equivalent
10-1	0.1
10-2	.01
10-3	.001
10-4	.0001
10-5	.00001
10-6	.000001
10-7	.0000001
10-8	.00000001

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1.0 PURPOSE AND NEED FOR AGENCY ACTION

The U.S. Department of Energy (DOE) has surplus uranium, in various forms, on the Hanford Site near Richland, Washington. Uranium has been used in the past on the Hanford Site in support of nuclear production operations; the Hanford Site's present mission is deactivation and remediation. DOE has identified approximately 2,000 metric tons of uranium (MTU) as surplus on the Hanford Site. The predominant amount (approximately 1,800 MTU) has been evaluated to have a positive market value and, as such, is considered an asset to DOE. Acquisition interest in the material previously has been expressed by both foreign-owned and domestic commercial organizations.

The remaining Hanford Site uranium (approximately 175 MTU) is being evaluated as two distinct groups, based on enrichment categories.[1] The two distinct groups are (1) material less than 1 weight percent uranium-235 and (2) material greater than 1 weight percent uranium-235. A key determining factor for the selected disposition of these two groups of materials is whether the cost for DOE and the taxpayer to condition the material into a marketable form exceeds the market value of the material. The less than 1 weight percent enrichment material (approximately 135 MTU) has been evaluated, by independent experts, as not economically feasible for required pre-treatment and subsequent sale. This material is being managed appropriately pending a final disposition determination. The remaining inventory (approximately 40 MTU in the second group) has potential monetary value. All of the approximately 175 MTU (both groups) are radiologically contaminated, with low levels of surface beta/gamma contamination (150 to 5,000 disintegrations per minute). Table 1 shows the current inventory of surplus uranium on the Hanford Site

DOE needs to (1) relocate saleable Hanford Site surplus unirradiated uranium (UU) to the DOE's Portsmouth Site near Portsmouth, Ohio, for future beneficial use; and (2) dispose of Hanford Site surplus uranium that is considered unsaleable. The removal of excess uranium from the Hanford Site supports a *Hanford Federal Facility Agreement and Consent Order* (Ecology et al. 1999) Milestone MX-92-06-T01 related to "complete commercial disposition and/or the acquisition of new facilities, modification of existing facilities, and/or modification of planned facilities necessary for storage, treatment/processing, and disposal/disposition of all Hanford Site UU," and U.S. Department of Energy, Richland Operations Office (DOE-RL) deactivation and mortgage reduction goals.

This proposed relocation action would be conducted as an interim action pending completion of an environmental impact statement (EIS) for the management of potentially reusable uranium materials at the DOE Uranium Management Center. The EIS would examine the packaging, transportation, receipt, and storage of these uranium materials with potential for beneficial reuse, including possible sale and disposition. Although the Portsmouth Site has been selected for the temporary storage of similar material, one or more sites would be evaluated for the longer term storage of useable uranium material. DOE's Oak Ridge Operations has begun the requisite steps necessary to prepare the aforementioned EIS. Preparation of the EIS is in accordance with the *National Environmental Policy Act* (NEPA) *of 1969* (P.L. 91-90, 42 U.S.C. 4321 et seq.) and the DOE NEPA Implementing Procedures (10 CFR 1021) to support publication of a Record of Decision (ROD) by late calendar year 2000. Mere physical relocation of the Hanford Site uranium inventory within the DOE Complex does not constitute non-proliferation issues.

The proposed disposal actions (if necessary) would be conducted as an interim action pending completion of DOE/EIS-0286, *Hanford Site Solid Waste (Radioactive & Hazardous) Program EIS*. The

[1] Enrichment is based on the isotopic uranium-235 content, by weight.

EIS (draft expected to be issued early in fiscal year 2000) evaluates the potential environmental impacts associated with ongoing activities of the Hanford Site Solid Waste Program, the implementation of programmatic decisions resulting from the *Final Waste Management Programmatic Environmental Impact Statement (PEIS)* (DOE/EIS-0200), and reasonably foreseeable treatment, storage, and disposal facilities/activities.

2.0 BACKGROUND

Uranium materials, in various forms and enrichments, were fabricated into fuel for use in the Hanford Site's production reactors and were byproducts from reprocessing plants. Enrichment is based on the isotopic uranium-235 content[2]. Uranium on the Hanford Site includes normal uranium [same assay as natural uranium (0.711 weight percent uranium-235) but created by a synthetic process], depleted uranium (assay less than natural uranium), and low-enriched uranium (assay between 0.711 weight percent and 20 weight percent uranium-235). A brief description of the materials follows (refer to Table 1 for Hanford Site surplus uranium inventory).

2.1 CANDIDATE URANIUM MATERIALS PROPOSED FOR TRANSPORT

Uranium Metal Billets. Metal billets are metallic forms of uranium that have been formed mechanically into hollow cylindrical shapes. Two sizes of billets, 'inner' and 'outer', were fabricated. The difference in the sizes is associated with the diameter of the billets. The 'inner' billets (Figure 1) have a nominal diameter of 14 centimeters (5.5 inches). The 'outer' billets have a larger diameter (nominally about 18 centimeters (7 inches) and have more mass; an inner billet weighs 125 kilograms (approximately 275 pounds), and an outer billet weighs 190 kilograms (approximately 420 pounds). The uranium billets presently stored on the Hanford Site are surplus materials because of the discontinued DOE defense reactor operations.

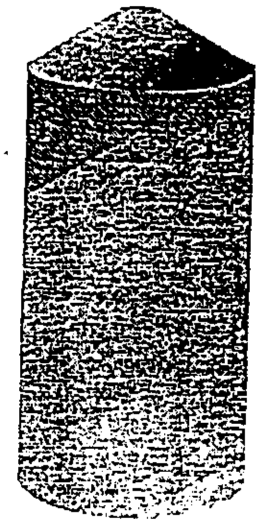
The surplus uranium billets currently are stored in wooden shipping containers in secured facilities in the 300 Area on the Hanford Site. The current 235 MTU metal billet inventory consists of 1,257 billets stored in 320 boxes: 1,255 billets (318 boxes) at an enrichment level (based on uranium-235 content) of 1.25 weight-percent; and 2 billets (2 boxes) at a 0.2 weight-percent enrichment level ('depleted' uranium). Also, there are 3 billets (1 box) of 0.95 weight-percent, and 2 billets (1 box) of normal (i.e., approximately 0.7 weight- percent). The facilities are monitored routinely and protected in accordance with DOE safeguards requirements. The dose rate on contact of a typical uranium billet is approximately 8 millirem per hour. The dose rate on contact of a wooden shipping container containing 4 billets is approximately 4 millirem per hour. The dose rate at the exterior of the storage facilities is indistinguishable from background levels.

Unirradiated Fuel Assemblies. The Hanford Site unirradiated fuel inventory (approximately 960 MTU) contains various types of assemblies; each type is characterized by the uranium-235 enrichment of the inner and outer fuel element and the fuel length. Fuel assemblies vary in length from 66 centimeters (26 inches) to 38 centimeters (15 inches). The average fuel assembly weighs 20 kilograms (approximately 44 pounds). The finished fuel assemblies are stored in 1,143 wooden boxes in the 300 Area of the Hanford Site (Figure 2). Of these boxes, 251 contain fuel assemblies that were loaded into N Reactor, but never irradiated. These assemblies, radiologically contaminated with low levels of surface beta/gamma contamination, were removed from the reactor, cleaned, packaged, and stored (double-wrapped in plastic). Unfinished fuel elements are stored in 339 wooden boxes.

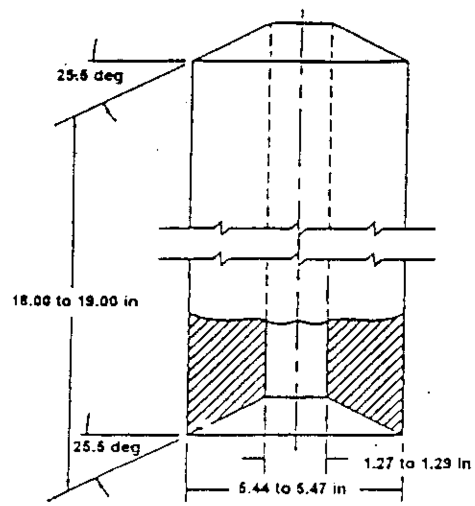
[2] The uranium materials may contain trace quantities (parts per million) of impurities including actinides, fission products and/or metals. Fuel fabrication operations included appropriate quality assurance checks and sampling programs to ensure product specifications were met.

Table 1. Excess Unirradiated Uranium Summary.

Form	Avg % U-235	MTU Quantity	Location
finished metal fuel assembly	0.95%	611.8	300 Area
finished metal fuel assembly	1.15%	133.7	300 Area
finished metal fuel assembly	1.03%	9.8	300 Area
finished metal fuel assembly	0.71%	65.3	300 Area
unfinished metal fuel assembly	1.25%	14.6	300 Area
unfinished metal fuel assembly	0.95%	113.5	300 Area
unfinished metal fuel assembly	0.71%	8.6	300 Area
fuel assembly subtotal		***957.3***	
metal billets	1.25%	233.6	300 Area
metal billets	0.95%	0.4	300 Area
metal billets	0.71%	0.3	300 Area
metal billets	0.2%	0.3	300 Area
billet subtotal		***234.6***	
UO_3	0.87%	668.5	200W Area
UO_3	0.2%	0.6	200W Area
UO_3 subtotal		***669.1***	
UO_2 (IN FUEL RODS)	2.35%	0.87	200E, 2718
UO_2 (IN MISC. CANS)	2.90%	0.13	300 Area
UO_2	0.71%	1.27	300 Area
UO_2	0.2%	2.2	300 Area
UO_2 subtotal		***4.47***	
	Totals	***1866***	



Billet, typical



Dimensions shown are for Inner Billet

Figure 1. Typical Uranium Billet.

Uranium Trioxide (UO_3). Low-enriched uranium trioxide (UO_3) powder (approximately 670 MTU) is stored in 147 T-hoppers (Figure 3) at the Uranium Oxide Plant in the 200 West Area of the Hanford Site. A small quantity [less than 200 kilograms (440 pounds)] of low-enriched UO3 powder is a residual heel in 38 'empty' T-Hoppers [T-Hoppers are truncated cylindrical vessels that can hold up to 5.4 MTU of powder (Figure 3)]. There also are several 208-liter (55-gallon) drums containing low-enriched, normal, and depleted UO_3 powder.

Uranium Dioxide (UO_2). The Hanford Site uranium dioxide (UO_2) inventory consists of 2,181 kilograms (approximately 4,800 pounds) of depleted uranium and 1,266 kilograms (2,800 pounds) of normal UO_2 pellets, powder and fuel pins containing UO_2 pellets. All of these materials except the fuel pins are stored in metal cans or drums.

Additionally, there is uranium dioxide in the 200 and 300 Areas of the Hanford Site that is predominantly 2.35 weight percent uranium-235. These materials include (1) 870 kilograms (approximately 1,900 pounds) of UO_2 powder within aluminum fuel tubes and (2) 130 kilograms (approximately 290 pounds) of miscellaneous pellets, powder, and scrap materials. Some of the aluminum fuel tubes are packaged in 415-liter (110-gallon) U.S. Department of Transportation (DOT) 6M containers, but most of the tubes are in 320-liter (85-gallon) criticality safe 'storage' containers that are not certified for transport. These materials might require repackaging or overpacking for shipment, as appropriate.

Figure 2. Fuel Assemblies in Storage.

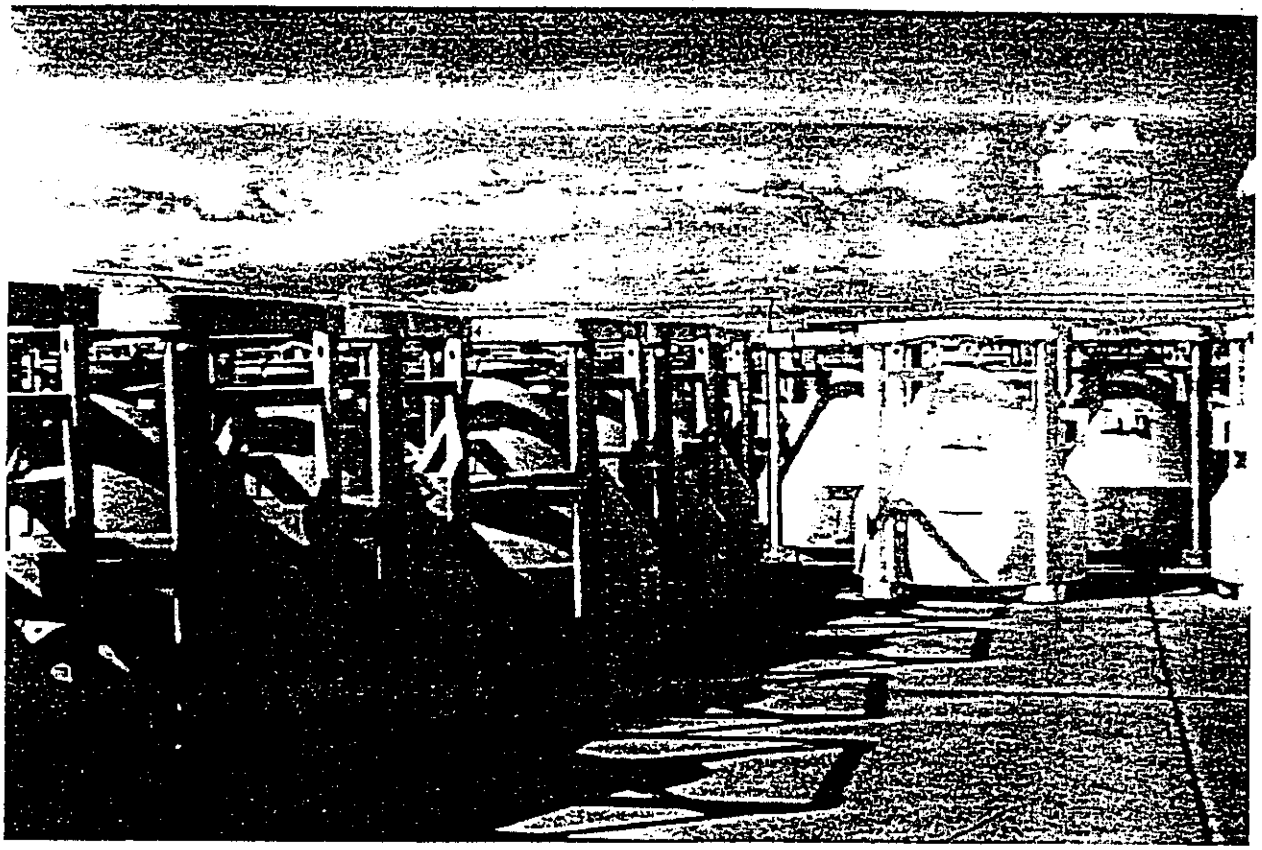


Figure 3. T-Hoppers.

2.2 REMAINING HANFORD SITE URANIUM MATERIALS

Presently, ongoing evaluations have not identified a positive market value for some uranium materials on the Hanford Site. As a management contingency, DOE would consider onsite disposition of these materials as low-level waste. A brief description of these materials follows.

Finished Fuel. There are approximately 135 MTU of finished fuel, wrapped in plastic and stored in wooden boxes in the 300 Area of the Hanford Site. This includes about 11 MTU of normal and 124 MTU of low-enriched uranium (0.95 weight-percent uranium). This material is radiologically contaminated, with low levels of surface beta/gamma contamination (150 to 5,000 disintegrations per minute).

UO_3 Powder. There are approximately 2 MTU of UO_3 powder stored in drums in the 200 West Area of the Hanford Site that is being considered for disposition as waste. This includes about 0.5 MTU of depleted uranium and 1.5 MTU of low-enriched uranium. This material is chemically similar to the UO_3 in the T-Hoppers.

UO_2 Powder. There is approximately 3 MTU of UO_2 powder stored in metal containers in the 300 Area of the Hanford Site that are undergoing evaluation regarding economic value.

Miscellaneous Uranium Materials. There are some miscellaneous uranium materials that are being evaluated for disposition as waste. This includes approximately 0.5 MTU of depleted uranium billets and about 0.5 MTU of miscellaneous residual scrap metal pieces from earlier fuel fabrication activities.

It would be expected that, in the event that no marketable value is identified, these materials would be appropriately packaged and transported from current storage locations to the 200 Areas of the Hanford Site for disposal as low-level waste. Additional details for potential management of these materials as waste are provided in Appendix A.

2.3 RELATED DOCUMENTATION

Similar activities have been addressed previously as discussed in the following sections.

2.3.1 Transportation

The proposed action is similar to activities conducted earlier (without significant environmental impacts) on the Hanford Site. Recent shipments of Hanford Site excess materials to the United Kingdom (i.e., uranium billets and low-specific activity nitric acid) have been the subject of environmental assessments (EAs). The EAs, each of which resulted in a Finding Of No Significant Impact, are incorporated by reference in this document:

- *Environmental Assessment for the Shipment of Low Enriched Uranium Billets to the United Kingdom from the Hanford Site, Richland, Washington* (DOE/EA-0787).
- *Environmental Assessment, Disposition and Transportation of Surplus Radioactive Low Specific Activity Nitric Acid, Hanford Site, Richland, Washington* (DOE/EA-1005).
- *Environmental Assessment, Transfer of Normal and Low-Enriched Uranium Billets to the United Kingdom, Hanford Site, Richland, Washington* (DOE/EA-1123).

In 1992 and 1996, a total of 1,040 metric tons (approximately 2,300,000 pounds) of uranium billets were shipped from the 300 Area to the United Kingdom. The potential impacts associated with the shipments were analyzed (DOE /EA-078 and DOE/EA-1123). The shipments were conducted without incident. The proposed action would pose similar potential hazards.

The proposed action involves the interstate transfer of billets, powder, and fuel assemblies, while the 1992 and 1996 campaigns involved international shipments of billets. The 1992 and 1996 campaigns used truck transportation from the Hanford Site to Seattle, Washington. At that point, billets were transferred to ocean vessels that transported the material through the Panama Canal to Germany, and to the United Kingdom.

Additionally, DOE recently has evaluated a similar action for the transfer of approximately 3,800 MTU of uranium materials currently stored at the Fernald Environmental Management Project (FEMP) Site to various Oak Ridge Operations managed sites. Identified Oak Ridge Operations managed sites included the Portsmouth Gaseous Diffusion Plant in Portsmouth, Ohio. The following EA was prepared concerning this site: DOE/EA-1299, *Environmental Assessment for the U.S. Department of Energy, Oak Ridge Operations Receipt and Storage of Uranium Materials from the Fernald Environmental Management Project Site*, (March 1999). A Finding Of No Significant Impact was issued on April 13, 1999. This EA also is incorporated by reference.

DOE has proposed the preparation of an EIS to address potential impacts associated with consolidation of potentially reusable uranium materials at a DOE Uranium Management Center. Potential storage sites would include three DOE sites in Oak Ridge, Tennessee (Y-12 Plant, East Tennessee Technology Park, and Oak Ridge National Laboratory), the Paducah Site in Kentucky, the Portsmouth Site in Ohio, the Savannah River Site in South Carolina, the Nevada Test Site, the Idaho Site, the Waste Isolation Plant in New Mexico, and appropriately licensed commercial sites. The EIS would address packaging, transportation, receipt, and storage of potentially reusable uranium materials at one or more sites. EIS preparation is expected to be initiated in calendar year 2000.

2.3.2 Waste Management

Radioactive waste materials are managed routinely on the Hanford Site. For example, in calendar year 1998, 1,470,000 kilograms (approximately 3,240,000 pounds) of radioactive waste were generated on the Hanford Site (PNNL-12088). Hanford Site waste disposal operations are being addressed in an environmental impact statement, which presently is being drafted. The draft Hanford Site solid (Radioactive and Hazardous) waste program EIS is anticipated to be issued during fiscal year 2000.

This NEPA review is proceeding concurrently with continued evaluation of the marketability of all forms of surplus Hanford Site uranium.

3.0 ALTERNATIVES INCLUDING THE PROPOSED ACTION

The proposed action and the alternatives are discussed in the following sections.

3.1 PROPOSED ACTION

Transportation of Hanford Site Uranium Materials

The DOE is proposing to transport 1,800 metric tons (approximately 4,000,000 pounds) of uranium materials currently stored on the Hanford Site in Richland, Washington, to Portsmouth, Ohio, for consolidated storage. These materials are considered potentially saleable by DOE. The shipments of the uranium materials would be appropriately categorized, per DOT specifications, for radioactive materials. Transport of the uranium materials could be conducted by overland truck and/or rail, specifically as follows.

- Approximately 75 shipments, via overland truck transport to Portsmouth, Ohio, would be required for the uranium billets. A shipping container of the uranium billets would have a dose rate of less than 0.5 millirem per hour at 1 meter (3 feet).

- Approximately 50 to 75 shipments, via overland truck transport to Portsmouth, Ohio, would be required for the UO_3 powder (2 to 3 T-Hoppers per truck, depending on weight restrictions). Rail transport of this material also is considered a possibility. A total of approximately 5 shipments via rail would be required (10 T-Hoppers per rail car; three rail cars per shipment). The T-Hoppers would have a dose rate of less than 20 millirem per hour at 1 meter (3 feet).

- Approximately 700 shipments, via overland truck transport to Portsmouth, Ohio, would be required for the fuel assemblies and other miscellaneous Hanford Site potentially saleable uranium materials. As with the aforementioned billets, a shipping container of the fuel assemblies would have a dose rate of less than 0.5 millirem per hour at 1 meter (3 feet).

Final mode/route selection would be based on cost, schedule, and operational considerations.

A typical sequence of activities for any necessary packaging and transportation includes several steps. For example, initially the billets, currently stored in wooden shipping containers, would be transferred from the existing storage facilities in the 300 Area (3712 Building and 303-G Building) to a nearby facility for appropriate repackaging. This could be similar to the action described in DOE/EA-1123. For that campaign, facilities considered included the 3712 Building [a facility in the 300 Area less than 1,000 meters (3,330 feet) away]. Relative locations of the 300 Area facilities are shown in Figures 4 and 5. (Note: the relative locations of the UO_3 storage area and the 2718-E Building are shown in Figures 6 and 7, respectively.)

Should repackaging be required, minor modifications at the specific location might be necessary. Modifications could include some form of temporary heating for operator comfort, as necessary, during the campaign. Temporary, portable hoisting and rigging equipment would be provided, including A-frame(s) and chain hoist(s), as well as any special handling tools. It is expected that the necessary equipment, most of which is of commercial design, is presently on the Hanford Site. Some handling equipment, which was used during earlier uranium transportation campaigns (DOE/EA-0787 and DOE/EA-1123), may be modified to interface with the current uranium materials inventories'

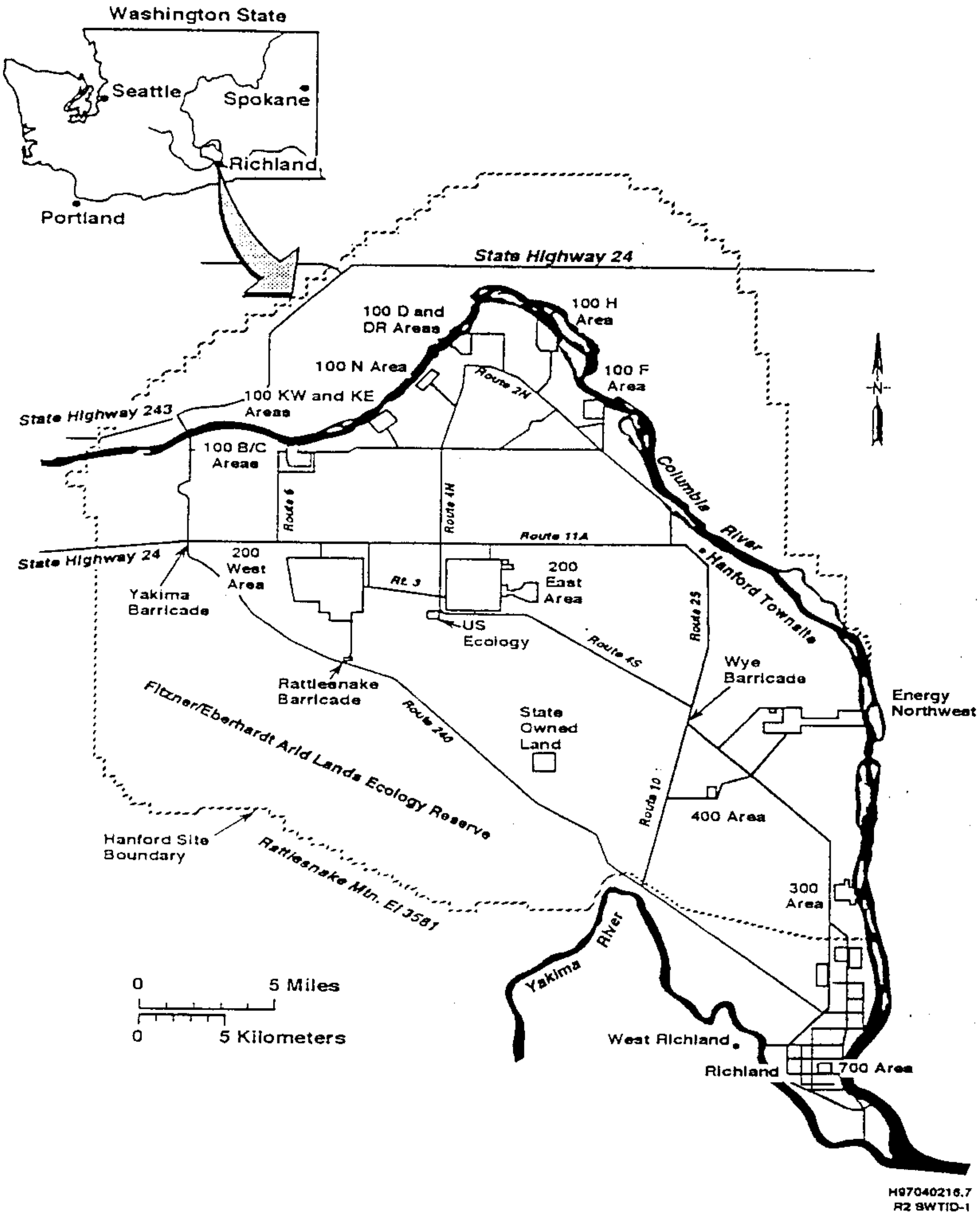


Figure 4. Hanford Site.

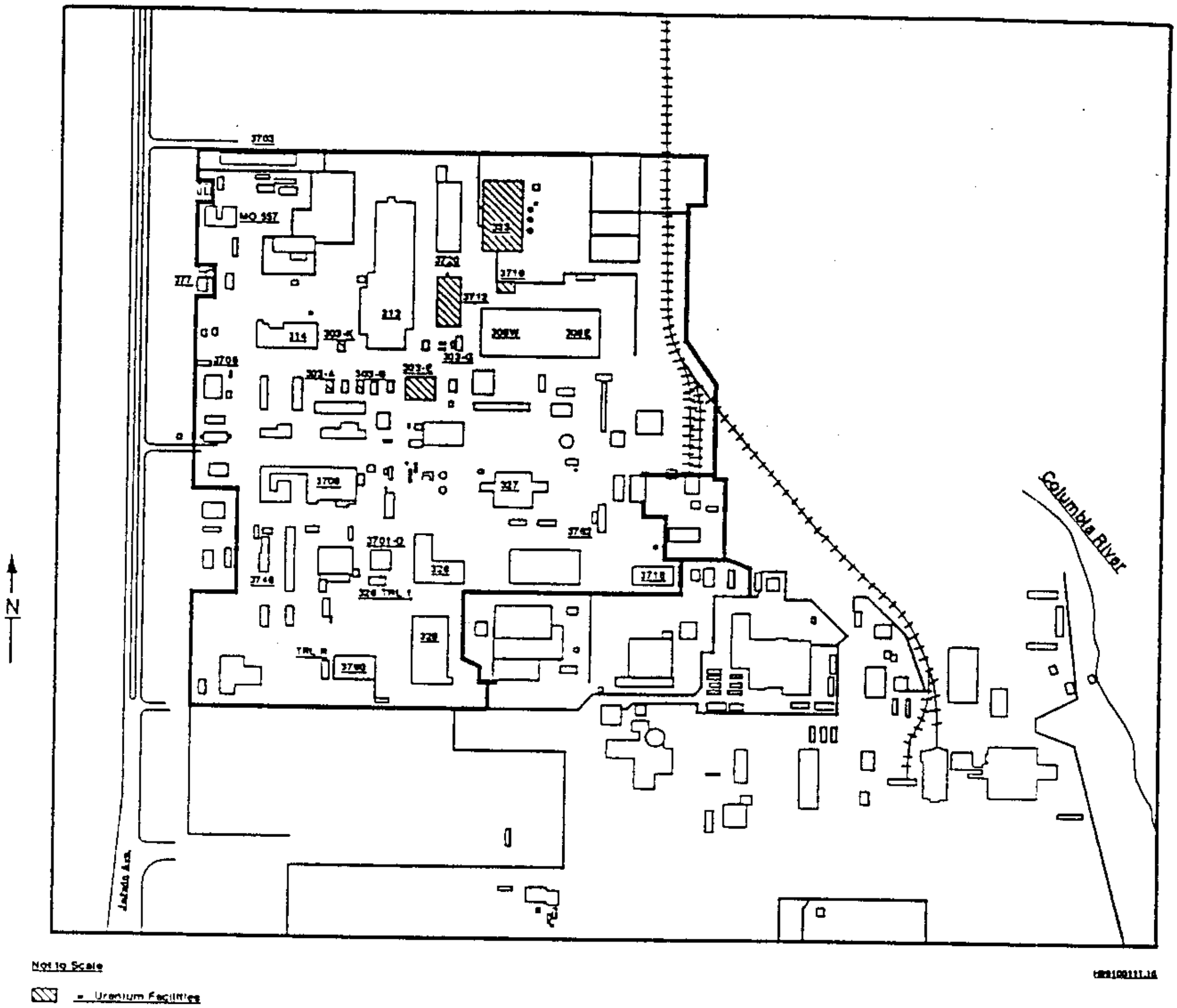


Figure 5. 300 Area Uranium Facilities.

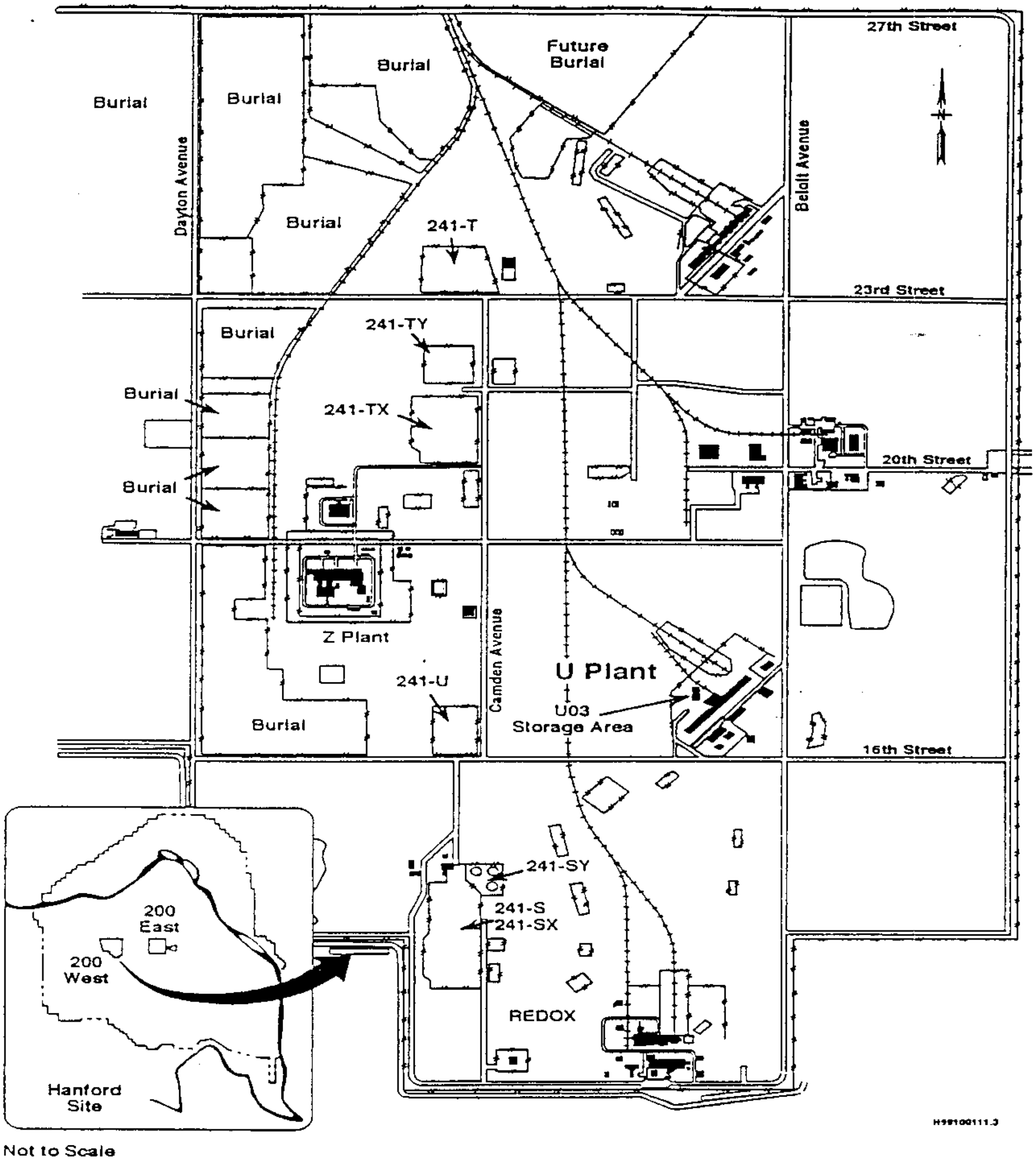


Figure 6. 200 West Area.

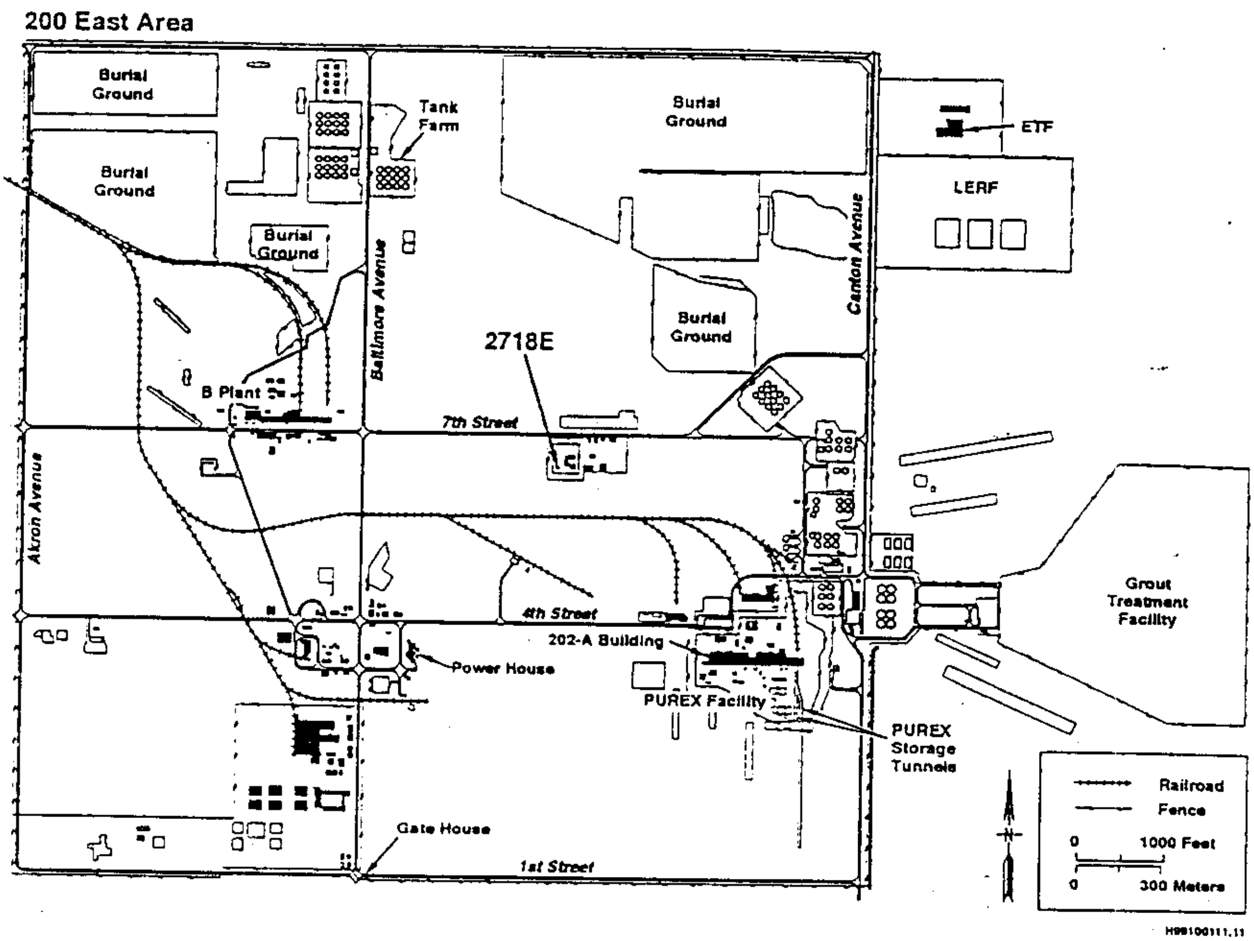


Figure 7. 200 East Area.

characteristics [e.g., billets outer- and inside-diameter dimensions and weight, fuel length, and A-frame/chain hoist(s)].

The materials would be transferred, as necessary, to appropriate DOT containers. It is expected that uranium billets might be shipped in their current configuration (i.e., wooden shipping containers), or might be repackaged to the extent required by DOT regulations.

The appropriate shipping containers (including T-Hoppers) would be appropriately secured on a truck trailer (and/or rail car) and radiologically measured by trained personnel using prescribed equipment and procedures before release. The procedures include provisions for carrier compliance with federal and state regulations for transport of radioactive materials. The procedures would ensure appropriate standards, specifications, and regulations, including DOT guidelines, and carrier security demands are met. The appropriate licensed commercial carrier would be contracted through appropriate DOE channels.

The proposed route for the transport of the uranium materials from the Hanford Site to Portsmouth, Ohio, is shown in Figures 8 and 9 (overland truck and rail routes, respectively). The transport of the uranium materials would fall under DOT regulations for radioactive materials and would be under the control of DOE. It might be necessary to amend the uranium materials' transportation route to secure an alternate route to address logistical or other reasonable concerns. Such circumstances, which could affect the selected route, including road closures, detours, and unanticipated inclement weather, are not expected to result in increased risk to the worker or public during transportation of the uranium materials.

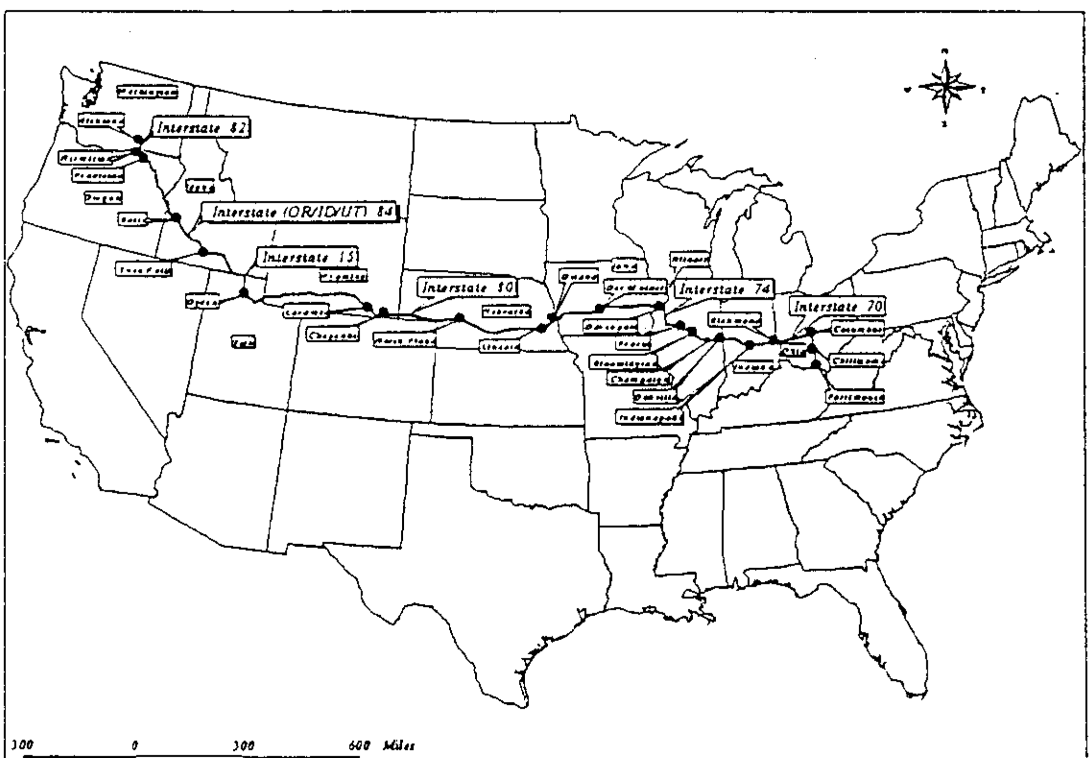


Figure 8. Proposed Overland Truck Route from Hanford Site to Portsmouth, Ohio.

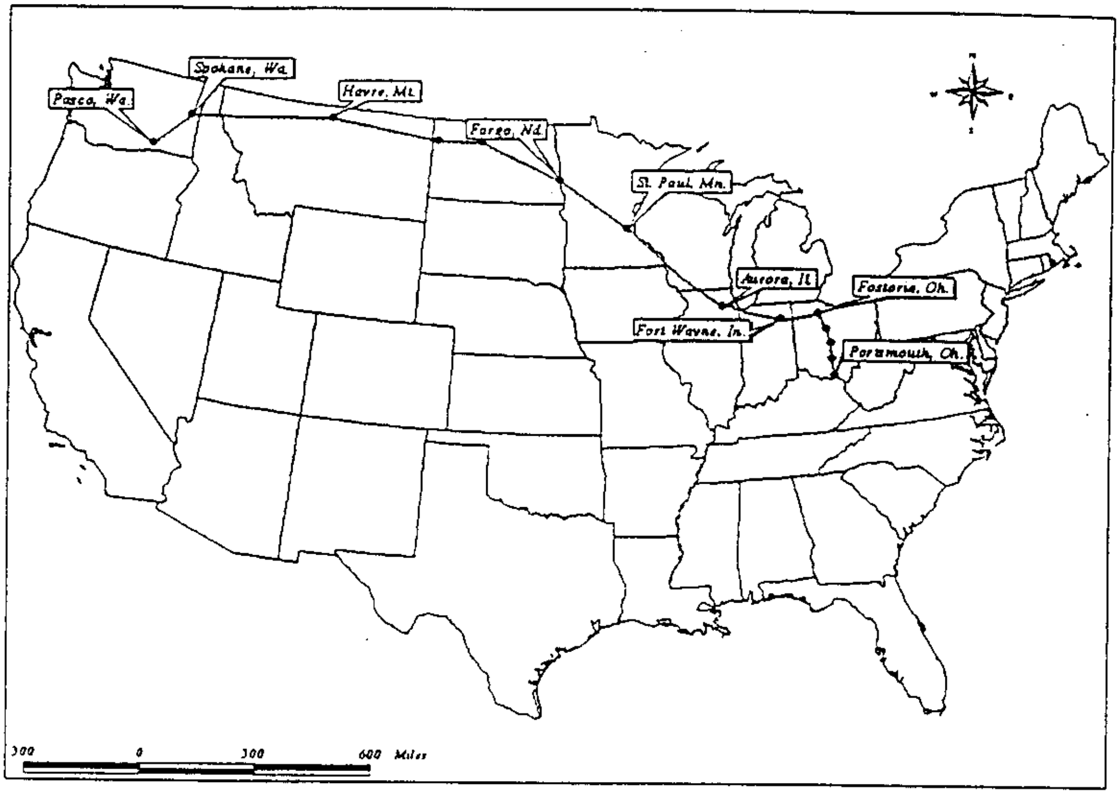


Figure 9. Proposed Rail Route from Hanford Site to Portsmouth, Ohio.

Once at the facility in Portsmouth, Ohio, the containers of uranium materials would be offloaded and stored in existing buildings or structures. The Hanford Site uranium materials would be stored in a transportation-ready configuration, not precluding future determination(s). These activities would be similar to, and consistent with, actions described in DOE/EA-1299, *Final Environmental Assessment for the U.S. Department of Energy, Oak Ridge Operations Receipt and Storage of Uranium Materials from the Fernald Environmental Management Project Site*. Any necessary modifications to the Portsmouth facilities would be expected to be minor; e.g., resurfacing asphalt pads, painting, utility modifications, radiation monitors. No transport containers would be returned to the Hanford Site for reuse.

After removal of the entire inventory of uranium materials from the existing storage facilities on the Hanford Site, electrical services to those facilities would be reduced to minimize maintenance costs while maintaining appropriate safety margins. End-point criteria would be developed supporting surveillance and maintenance activities. The facilities would remain locked until decommissioned or transferred to a new owner. The temporary equipment would be decontaminated, if necessary, and reused or excessed as appropriate.

Hanford Site Uranium Materials – Candidates for Waste Disposition. Uranium materials (up to approximately 140 MTU) that might be designated as waste would be appropriately packaged and transported from the present location to the 200 Areas low-level burial grounds on the Hanford Site for disposal. It is expected that potential modifications to existing facilities would be consistent with the ongoing disposal mission at the burial grounds. Appendix A provides additional details regarding the potential disposition of these uranium materials as waste.

3.2 ALTERNATIVES TO THE PROPOSED ACTION

Alternatives to the proposed action are as follows.

3.2.1 No-Action Alternative

Under the No-Action Alternative, the Hanford Site uranium materials would remain in the existing, onsite storage configurations. This alternative does not address the actual disposition of the material, and would result in continued surveillance and maintenance with the attendant costs for safeguards and security and utility assessments.

3.2.2 Alternative Storage Locations for Saleable Hanford Site Uranium

At the present time, no alternative locations other than the Portsmouth Site for offsite storage of the Hanford Site uranium materials have been identified. The proposed action is consistent with the recent DOE decision to transfer FEMP uranium materials to the Portsmouth Site (DOE/EA-1299). The Portsmouth Site offers unique capabilities for uranium storage, including infrastructure.

3.2.3 Disposal of Entire Hanford Site Surplus Uranium Inventory

Presently, some value has been identified for the majority of the surplus Hanford Site uranium inventory. Disposal of the entire inventory would not recognize any potential benefits from sale or reuse of the materials, and would require large incremental funding allocations.

3.2.4 Alternative Transportation Modes

Other modes of transportation, such as air transport or barge, were considered. The potential hazards and risks associated with such transport would be similar to those experienced with overland transport. The mode preferred by DOE is overland transport of the surplus material. The following discussion of alternative modes is provided for completeness.

Air transportation of the uranium materials would be possible, although it would be more expensive than other forms of transportation. Radiation doses to persons not involved in the transportation essentially would be zero under normal conditions. As stated in the National Transportation Statistics, Annual Report for 1992 (DOTVNTSC-RSPA92-1), the probability of an air accident is about 20 times less than the probability of a truck accident, on a per-mile basis. Therefore, the risk from an air crash is low.

Barge transport of the uranium materials is considered impractical. Defueled submarine reactor compartments are transported routinely by barge via the Columbia River to the Hanford Site for disposal. However, ready access to the Portsmouth Site via waterway is not available.

4.0 AFFECTED ENVIRONMENT

The affected environment includes the potential transportation routes (generally interstate highways and rail routes), in addition to the Hanford Site and the Portsmouth Site. The general environmental description of the routes was considered in the route-specific aggregate data used to analyze transportation impacts. Details regarding the Hanford Site can be found in the *Hanford Site 1998 Environmental Report* (PNNL-12088) and *Hanford Site National Environmental Policy Act* (NEPA) *Characterization* (PNNL-6415). Details regarding the Portsmouth Site can be found in DOE/EA-1299.

4.1 HANFORD SITE

Surplus uranium materials are located in the 200 West Area, 200 East Area, and the 300 Area of the Hanford Site in the southeastern portion of the State of Washington. Involved portions of the 300 Area are approximately 1 kilometer (0.6 mile) west of the Columbia River, the nearest natural watercourse. The nearest population center is the adjoining City of Richland, to the south. The City of Richland has a population of 32,315, while the population within an 80-kilometer (50-mile) radius of the 200 Areas is approximately 375,860.

The Hanford Site has a semiarid climate with 15 to 18 centimeters (6 to 7 inches) of annual precipitation, and infrequent periods of high winds of up to 128-kilometers (80-miles) per hour. Tornadoes are extremely rare; no destructive tornadoes have occurred in the region surrounding the Hanford Site. The probability of a tornado hitting any given waste management unit on the Hanford Site is estimated at 1 chance in 100,000 during any given year. The region is categorized as one of low to moderate seismicity.

The surplus uranium storage locations are not located within a wetland or in a 100- or 500-year floodplain. Threatened and endangered plants and animals identified on the Hanford Site, as listed by the federal government (50 CFR 17) and Washington State (Washington Natural Heritage Program 1997) are not found in the vicinity of the uranium storage areas, and are discussed in PNNL-6415. No plants or mammals on the federal list of threatened and endangered wildlife and plants (50 CFR 17) are known to occur on the Hanford Site. There are, however, three species of birds (Aleutian Canada goose, bald eagle, and peregrine falcon) and two species of fish (steelhead and spring-run chinook salmon) on the federal list of threatened and endangered species. Several species of both plants and animals are under consideration for formal listing by the federal government and Washington State. Details are provided in PNNL-6415, and are incorporated by reference in this EA.

Cultural resources in the area of the surplus uranium storage locations have been considered. The 300 Area of the Hanford Site and the location of the uranium fuel fabrication plants that manufactured fuel rods to be irradiated in the Hanford Site reactors provided the first essential step in the plutonium production process. One hundred fifty-eight buildings/structures in the 300 Area have been inventoried on historic property inventory forms. Of that number, 47 buildings/structures have been determined eligible for the National Register as contributing properties within the Historic District recommended for mitigation; included in that list are the 303-A Building, the 333 Building, and the 3716 Building Assessments of the contents of the 333 Building resulted in identification/tagging of artifacts such as safety signs/posters, a control panel, protective worker clothes, and a sample uranium fuel element. No artifacts were identified in an assessment of the 3716 Building. No specific Cultural Resources Review was conducted for the proposed action because no ground disturbance or facility modifications are planned as part of the proposed action. Additional information regarding the cultural resources on the Hanford Site can be found in PNNL-6415.

4.2 PORTSMOUTH SITE

The Portsmouth Site is located approximately 36 kilometers (22 miles) northeast of Portsmouth in Pike County, Ohio. The site occupies an area of approximately 15 square kilometers (6 square miles). The site's region of influence includes both Pike County, where the facility is located, and Scioto County, which includes Portsmouth, the nearest city. The population of the two counties, per 1996 data, is approximately 108,000. There is roadway access via major arteries connecting the area with interstates, as well as air, bus and rail service.

Construction of the site began in late 1952 and ended in 1956, 1 year after the start of uranium enrichment processing on the site. On July 1, 1993, DOE leased portions of the site to the United States Enrichment Corporation for the purpose of managing and operating the uranium enrichment enterprise. DOE retains responsibility for the non-leased portions of the site, which consist primarily of environmental restoration and waste management activities.

Building 744-G, the primary receipt facility under consideration, has been upgraded to receive the Fernald uranium and space is available within that facility to receive the surplus Hanford Site material. The facility is a steel-framed building with a concrete floor. The facility has standard electrical service, sanitary water, dry-pipe sprinkler systems, and radiation alarm clusters. The facility, termed the Uranium Management Center, is expected to house a total of approximately 5,900 MTU (13,000,000 pounds) of uranium materials. Additional details regarding the environment pertaining to the Portsmouth Site may be found in DOE/EA-1299.

4.3 TRANSPORTATION CORRIDORS

Proposed transportation corridors are shown in Figures 8 (overland truck) and 9 (rail). The potential routes would be predominantly established interstate highways or railways, traversing a variety of terrains. Diverse populations (in metropolitan, urban and rural settings) would be along the approximately 4,000 kilometers (2,400 miles). The vast array of flora and fauna common to the U.S. ecosystem would be expected to be encountered during transport.

5.0 ENVIRONMENTAL IMPACTS

The following sections present quantitative information on those potential environmental impacts that have been identified as a result of activities being proposed for the packaging of uranium materials at the Hanford Site, and subsequent transport of the material to the Portsmouth Site for storage, or to the Hanford Site 200 West Area for disposal. Both routine operations (incident-free packaging and transportation) and accident scenarios are analyzed in Sections 5.1 and 5.2, respectively.

The proposed action is not expected to result in radiological or hazardous material releases to the environment. All activities would comply with current DOE Orders and state and federal regulations.

The low level of radioactivity associated with the uranium materials makes the risks associated with the handling and transportation of the uranium materials small. There would be low radiation exposure associated with packaging the uranium materials. A toxicological hazard exists because of the potential for an accidental release of the material in particulate form to the environment. However, the uranium materials currently are packaged appropriately for the respective forms [e.g., billets (large, solid metal masses stored in wooden boxes); or uranium oxide powder (stored in T-Hoppers)]. These storage configurations readily would not release particulates[3].

It is expected that potential personnel exposure to both radiation and hazardous materials during routine handling and offloading operations at the Portsmouth Site, and subsequent storage activities, would be no greater than existing conditions at those locations. Appropriate procedures would be in place to ensure minimum exposure to radiation and hazardous materials [in keeping with as low as reasonably achievable (ALARA) principles] and to ensure maximum employee and public safety. Potential impacts associated with both routine operations and accidents would be expected to be bounded by those described in the following sections for activities at the Hanford Site and for interstate transportation.

5.1 PROPOSED ACTION: IMPACTS FROM ROUTINE OPERATIONS

Impacts from routine operations are described in the following sections.

5.1.1 Uranium Materials Packaging and Loading at Hanford Site Locations, and Offloading/Storage at the Portsmouth Site

The potential for release of uranium during packaging and loading/offloading exists. However, appropriate controls would be in place to maintain occupational radiation exposure well below DOE regulations of 5,000 millirem per year (10 CFR 835), in keeping with ALARA principles. Additionally, appropriate procedures and administrative controls (e.g., personnel training and a radiation work permit) would be in place before any proposed activities. Also, radiation and hazardous chemical worker

[3] The chemical composition of Hanford Site uranium powder and billets was specified to control the fabrication, nuclear reactivity, and irradiation stability characteristics of the metal. The uranium-235 concentration was specified to control the nuclear reactivity of the uranium. Metal density was specified primarily to control the microscopic metal soundness and as a secondary control on both nuclear reactivity and chemical purity.

Trace amounts of chemical components (in parts per million) could be present as impurities in the uranium powder and billets. Specifications included concentrations limits for: actinides (e.g., thorium); fission products (e.g., ruthenium-106); and metals (e.g., iron, aluminum, beryllium). Impurities were not considered in calculating potential impacts.

exposure levels would be monitored during the proposed action (i.e., personal dosimeters and continuous air monitors, as required).

Most of the potential radiological exposure would be expected for the workers involved in the proposed packaging, because of the handling of the slightly radioactive uranium materials in their present storage locations. The maximum expected whole body total dose for an estimated workforce of 5 workers (for any particular type of surplus material) would be a small fraction of the average annual exposure to radiation by Hanford Site/Portsmouth personnel from ongoing activities at those sites.

For example, uranium billets are stored in the 300 Area on the Hanford Site. Average occupational external whole-body exposure to personnel in the 300 Area due to routine operations in calendar year 1998 was 83 millirem per year; the 1998 annual average external background dose rate (measured in communities considered distant from the Hanford Site) was approximately 70 millirem per year (PNNL-12088). This is substantially less than the maximum DOE regulatory standard of 5,000 millirem per year. Based on a dose-to-risk conversion factor of 4.0 x 10-4 (onsite) latent cancer fatalities (LCF) per person-rem (56 FR 23363), no LCFs would be expected.[4] Exposures to noninvolved workers could result from air emissions during packaging activities, but the collective doses would be much smaller than those for directly involved workers because such emissions would be small.

No public exposure to radiation above that currently experienced from routine Hanford Site operations is anticipated as a result of these actions. As reported in PNNL-12088, the potential dose to the maximally exposed individual during calendar year 1998 from Hanford Site operations was 0.02 millirem. The 1998 average dose to the population was 0.0005 millirem per person. Collectively, the potential dose to the local population of 380,000 persons from 1997 operations was 0.2 person-rem. The current DOE radiation limit for an individual member of the public is 100 millirem per year, and the national average dose from natural sources is 300 millirem per year. The low doses associated with the total inventory of uranium billets at the 300 Area would not contribute to offsite public exposure. With no additional offsite exposure involved with the packaging and loading of the uranium billets, no adverse health effects to the public are expected. Similar expectations would hold true for the other forms of Hanford Site surplus uranium.

No toxicological exposure to workers or the general public is expected to occur as a result of routine handling of the uranium materials, either during packaging, loading or offloading activities. The materials would be handled in a manner consistent with packaging and transportation of radioactive solid materials. Hanford Site and Portsmouth personnel routinely handle these types of materials daily. Routine procedures (e.g., use of personnel protective clothing), specific training, and equipment safeguards are in place, and are adequate to ensure the safe packaging and handling of this material.

Small quantities of hazardous materials (e.g., solvents, cleaning agents) that might be generated during the proposed action at the present storage locations would be managed and disposed in accordance with applicable federal and state regulations. Radioactive material, radioactively contaminated equipment, and mixed waste at the storage locations would continue to be appropriately packaged, stored, and/or disposed at existing facilities on the Hanford Site. The wooden shipping containers, if no longer needed, would be disposed as low-level solid waste in existing Hanford Site waste disposal facilities.

[4] For additional perspective, during the 1995 to 1997 reporting years, the average dose to workers in DOE facilities that process unirradiated uranium, such as uranium enrichment and fuel fabrication facilities, averaged approximately 35 millirem per year (DOE/EH-0575).

The proposed action is not expected to impact the flora and fauna, air or water quality, land use, or to have socioeconomics effects. Noise levels would be comparable to existing conditions on the Hanford Site and at the Portsmouth site. No cultural resources would be impacted because no ground disturbance or permanent facility modifications are planned as part of the proposed action. The amount of equipment and materials to be used, such as fuel for transportation, represents a minor commitment of nonrenewable resources.

5.1.2 Transportation

This section addresses the impacts of incident-free truck transport of uranium materials in the continental U.S. from the Hanford Site to the Portsmouth Site in Ohio. These data are based on computer analyses (RADTRAN) conducted specifically for these materials (ENG-RCAL-028, *Transportation Risk Assessment for the Shipment of Uranium Billets and UO3 Powder from Hanford to Portsmouth, Ohio*). Rail transport of the T-Hoppers is a viable consideration; therefore, the rail transport for uranium oxide was included in the analysis.

For analysis, it conservatively was assumed that the dose rate at 1 meter (3 feet) from the surface of the shipping container was 1 millirem per hour. [NOTE: Measurements of the container during the 1992 campaign for transport of uranium billets to the United Kingdom indicated the actual dose rate was less than 0.5 millirem per hour at 1 meter (3 feet)]. A similar dose rate [i.e., 0.5 millirem per hour at 1 meter (3 feet)] is anticipated to be representative of the current inventory of uranium materials, per shipping container, associated with the proposed action.

5.1.2.1 RADTRAN 4

The RADTRAN 4 computer code yields conservative estimates of radiological exposure to workers and the public (SAND89-2370). Additional conservatism inherently comes from the assumptions that are made in selecting data in the program itself; for example, in the absence of actual measurements, the highest allowable external radiation level for a package (under transportation regulations) was used. In practice, packaging arrangements reduce this below the assumed level by a factor of 10.

5.1.2.2 Potential Impacts

The shipment characteristics necessary to calculate the radiological impacts of transport include the type of transportation packaging, the number of shipments, and the quantity of radioactive material within the package (referred to as the 'inventory'). These parameters are presented in the RADTRAN analysis for the transportation packaging considered in this EA. Some of the information also is used in the analysis of transportation accidents, which is provided in Section 5.2.

Radiological impacts during normal transport involve dose to the public from radiation emitted by radioactive material packages as the shipment passes by, and to transport workers who are in the general vicinity of a radioactive material shipment. Even though radiation shields are incorporated into packaging designs, some radiation penetrates the package and exposes the nearby population at extremely low dose rates. After the shipment has passed, no further exposure occurs. No toxicological impacts would occur during normal transport. The groups exposed to radiation while the shipments are in-transit include truck drivers and rail crews, those who directly handle radioactive shipments while in route, and the general public (e.g., bystanders at truck/rail stops, persons living or working along a route, and nearby travelers (moving in the same and opposite directions). The RADTRAN 4 computer code (SAND89-2370) was used to calculate exposures during transport to these population groups.

The potential impacts associated with incident-free transport of uranium billets and uranium oxide powder (for analyses, the bounding inventories) via truck/rail are provided in Table 2. The total dose to truck crews (workers) would amount to 0.07 person-rem for shipments of uranium billets from the Hanford Site to Portsmouth, Ohio. Transport of uranium oxide powder by truck would result in 0.37 person-rem to workers (transport via rail would provide a reduction in dose to workers to 0.09 person-rem). Total public doses were calculated to be 0.08 person-rem (billets), 0.35 person-rem (uranium oxide via truck transport), and 0.43 person-rem (uranium oxide via rail). The public doses would result predominantly from exposures received during stops enroute. There were no excess LCFs predicted. Specifics such as number of workers (2), persons exposed during stops (50), and average exposure during stops (0.5 millirem per hour at 1 meter from the cask) are provided in ENG-RCAL-028.

Circumstances that could affect the selected route (e.g., road closures, detours, unanticipated inclement weather) are not expected to result in increased risk to the worker or public during transportation of the uranium materials.

Table 2. Radiological Impacts of Incident-Free Transportation.

Description	Worker	Public	Total
Shipment of Billets from Hanford, Washington to Portsmouth, Ohio via Truck			
Total Dose (person-rem)	0.07	0.08	0.15
Latent Cancer Fatalities	2.8E-05	3.9E-05	6.7E-05
Shipment of UO_3 Powder from Hanford, Washington to Portsmouth, Ohio via Rail			
Total Dose (person-rem)	0.09	0.43	0.52
Latent Cancer Fatalities	3.7E-05	2.1E-04	2.5E-04
Shipment of UO_3 Powder from Hanford, Washington to Portsmouth, Ohio via Truck			
Total Dose (person-rem)	0.37	0.35	0.73
Latent Cancer Fatalities	1.5E-04	1.8E-04	3.3E-04
Shipment of Fuel Assemblies from Hanford, Washington to Portsmouth, Ohio via Truck			
Total Dose (person-rem)	0.53	0.08	0.61
Latent Cancer Fatalities	2.1E-04	4.1E-05	2.5E-04

5.1.3 Potential Disposition of Uranium Materials as Waste

Appendix A provides a discussion of potential impacts associated with a future decision to dispose of unsalable Hanford Site uranium materials onsite, should such a decision be forthcoming. As stated in the Appendix, disposal of up to 140 MTU of uranium materials would be conducted in existing facilities in the 200 Areas of the Hanford Site. Such disposal would result in less than 400 cubic meters (14,100 cubic feet) of waste, and would not be expected to substantially impact day-to-day Hanford Site waste disposal operations.

5.2 PROPOSED ACTION: IMPACTS FROM ACCIDENTS

Impacts from accidents are discussed in the following sections.

5.2.1 Packaging of Uranium Materials at the Hanford Site

Postulated accidents associated with the repackaging of the uranium materials on the Hanford Site have been considered, and are believed to be bounded by those potential events associated with transportation accidents (Section 5.2.2). The environmental effects of accidents related to the repackaging are limited to those associated with most routine industrial activities. There are no specific initiators related directly to the proposed action that would cause a criticality or a fire. For example, the minimal dose rate (8 millirem per hour on contact) from the uranium billets would not pose an acute or chronic hazard in the event of a drop of a container of uranium billets.

Personnel injuries, such as back strains or minor abrasions, would receive appropriate medical treatment. Administrative controls, proper training and specification of detailed procedures used in handling the materials would be in place, all of which would minimize the potential of any effects of such an accident.

5.2.2 Transportation

Potential accidents associated with the transportation of uranium materials from the Hanford Site to Portsmouth, Ohio, have been analyzed (ENG-RCAL-028). The severity of consequences depends on the degree to which the materials would be converted to airborne particulates, the extent of exposure to such a release, and the specific location of the affected individual(s). Material safety data sheets provide information regarding hazards of uranium. Symptoms of exposure to uranium particulates or powder could include burning sensation, coughing, wheezing, laryngitis, shortness of breath, headache, nausea and vomiting. Uranium particulates or powder are extremely destructive to tissue of the mucous membranes and upper respiratory tract, eyes, and skin.

The analyses herein consider the affected public and the drivers/rail crews directly associated with uranium shipments. Fatalities as a result of vehicular/rail impact are not specifically analyzed within the scope of this document; it would be expected that potential fatalities would be a small fraction of transportation fatalities that occur in the United States annually. For perspective, fatalities involving the shipment of radioactive materials were surveyed for 1971 through 1993 using the Radioactive Material Incident Report database. For 1971 through 1993, 21 vehicular accidents involving 36 fatalities occurred. These fatalities resulted from vehicular accidents and were not associated with the radioactive nature of the cargo; no radiological fatalities because of transportation accidents have ever occurred in the United States. During the same period of time, over 1,100,000 persons were killed in vehicular accidents in the United States (DOE/EIS-0283-D).

Specific environmental impacts to surface water, groundwater, soils, and/or sediments along the transportation corridors as a result of an accidental release of materials are not quantified in this document. It would be expected that drivers/rail crews immediately would take appropriate measures to limit the spread of any contamination, and would support first responder actions.

In the event that an individual could not evacuate the immediate vicinity of a potential accident scene, the individual might or might not be directly exposed to material. The effects to an individual as a result of exposure to any chemical are a result of time of exposure, concentration, and distance. The specific exposure to an individual who is unable to evacuate would depend on the extent of a spill (i.e., the amount of material released), their proximity to the spill, and the meteorological conditions. For distances less than 100 meters (330 feet), it is assumed that the direct physical injuries due to the vehicular accident itself would be the principle hazard; otherwise, the individual would be able to evacuate the area and minimize their exposure. Additionally, the initial response by the crews and/or the emergency response personnel would reduce the risk and exposure of individuals unable to evacuate the accident scene.

Should the crew(s) be unable to take protective action, such as exiting the vehicle and moving out of any irritating plume (upwind) to a distance of at least 100 meters (330 feet), it is possible that they might be exposed to concentrations of materials, including airborne uranium (in the event of a fire) and fuel vapors that could cause destruction to tissue of the mucous membranes and upper respiratory tract, eyes, and skin. However, proper emergency response (e.g., flushing affected external areas with water while removing contaminated clothing) would minimize the amount of permanent physical damage to the individual(s). As discussed in the following, potential accidents could result in minimal impact to worker and public health and safety.

States and tribes having jurisdiction over areas through which these shipments would pass have the primary responsibility for protecting the public and the environment, and for establishing incident command should there be an emergency involving the shipments. DOE would provide technical advice and assistance to authorities and carriers when requested. The selected carrier for these shipments has the primary responsibility for providing emergency response assistance and recovery/restoration actions if required.

In the event of a highway incident, where the transport container is involved, the driver/first responder would notify the appropriate state control, the carrier's central dispatch facility, and the shipper. In the event of an accidental release of the uranium, the carrier is required to notify the National Response Center per DOT (49 CFR 171, General Information, Regulations, and Definitions, and 49 CFR 172.600, Emergency Response Information) and U.S. Environmental Protection Agency (40 CFR 302, Designation, Reportable Quantities, and Notification) regulations. The National Response Center would provide appropriate response in support of recovery/restoration.

Emergency response guides accompany each shipment. These guides are attached to the bill of lading. The driver would be in control of these documents at all times during shipment. These guides address the potential toxicological and radiological hazards associated with the material. The guides also include a telephone number, staffed 24-hours a day, that could be called for emergency assistance. In the event that the paperwork was inaccessible (e.g., a fire in the transporter cab), a first responder could contact the chosen carrier, which would provide emergency response information.

The container would be marked and placarded in accordance with DOT regulations. Placards indicating the radioactive nature of the shipment would be permanently attached to the transport containers. These visual warnings would provide information to first responders and the general public regarding the hazards and appropriate emergency response.

Specific details regarding emergency preparedness, notifications, and emergency response would be found in the transportation plan, currently being prepared for the shipment of the uranium materials.

The impacts associated with potential transportation accidents are expressed as risk. For this analysis, risk is defined as the product of the probability of occurrence of an accident involving uranium materials and the consequences of an accident (ENG-RCAL-028). Consequences are expressed in terms of the health effects from a release of uranium from the packaging.

Probability categories for accidents range from anticipated to incredible events (WHC-CM-4-46). That is, an anticipated event is one where the annual frequency ranges from 1 to 1×10^{-2} (one chance in one hundred). An unlikely event has an annual frequency range from 1×10^{-2} (one chance in one hundred) to 1 x 10^{-4} (one chance in ten thousand). An extremely unlikely event has an annual frequency range from 1 x 10^{-4} (one chance in ten thousand) to 1 x 10^{-6} (one chance in one million). Incredible events have a frequency of less than 1 x 10^{-6} (one chance in one million).

The maximum credible accident associated with the shipping container was analyzed for the shipment of Hanford Site surplus materials to Portsmouth, Ohio. The accident consisted of a collision, which engulfs the entire shipment of uranium material in a fire, thus providing the maximum radiological release to the public (and is presented as the bounding consequence scenario). Should an accident involving uranium materials during shipment occur, a release of material could occur only if the transport packaging were to become breached. The RADTRAN 4 computer code was used to calculate the potential radiological impacts of such an event. Details of the analysis are provided in ENG-RCAL-028.

The results (Table 3) indicate that the total calculated dose from a maximum credible accident during continental U.S. (overland truck) uranium billet shipments to Portsmouth, Ohio, conservatively was estimated to be 0.08 person-rem. This equates to 0.00004 LCFs. Similarly, the total risk for uranium oxide powder (accident scenario) was 0.03 person-rem (0.00002 LCFs) via rail; 0.06 person-rem (0.0003 LCFs) via truck. The total risk for fuel assemblies (accident scenario) was 0.1 person-rem (0.00005 LCFs) via truck.

Table 3. Potential Transportation Radiological Accident Risks.

Shipment of Billets from Hanford, WA, to Portsmouth, OH, via Truck	
Total Dose (person-rem)	7.9E-02
Latent Cancer Fatalities	4.0E-05
Shipment of UO_3 Powder from Hanford, WA, to Portsmouth, OH, via Rail	
Total Dose (person-rem)	3.3E-02
Latent Cancer Fatalities	1.6E-05
Shipment of UO_3 Powder from Hanford, WA to Portsmouth, OH, via Truck	
Total Dose (person-rem)	5.9E-02
Latent Cancer Fatalities	2.9E-05
Shipment of Fuel Assemblies from Hanford, WA to Portsmouth, OH via Truck	
Total Dose (person-rem)	1.1E-01
Latent Cancer Fatalities	5.2E-05

Nonradiological consequences of the transportation of uranium materials also were evaluated (ENG-RCAL-028). For analysis, consequences were due to the chemical toxicity of uranium that could result from an accidental release (in grams per second or total grams, for billets or T-Hopper shipments, respectively) during transport of the UO_3 powder and metallic billets. The toxicological consequences (Table 4) are given in terms of the concentrations of airborne uranium particulates (in milligrams per cubic meter) at various receptor locations (meters from the event). The calculated concentrations are compared to various exposure limits to evaluate the effects of the release on the public.

Table 4. Potential Toxicological Consequences from an Accident.

Receptor Location, meter	Truckload Billets, 0.045 grams per second release rate		T-Hopper Shipments, 4.1 gram total release	
	Concentration, milligrams per cubic meter		Concentration, milligrams per cubic meter	
100	0.17	< TEEL-1	1.3	< TEEL-3
200	0.04	< TEEL-0	0.19	< TEEL-1
1,000	3.00E-3	< TEEL-0	2.9E-03	< TEEL-0
100, rare case*	1.3	< TEEL-3	10.7	> TEEL-3

*The 'rare case' refers to worst-case meteorological conditions of wind speed (1 meter per second) and atmospheric turbulence (Pasquill stability class F) that cause a maximum concentration. These conditions tend to disperse the released material very slowly, resulting in the highest possible downwind concentrations. However, these conditions rarely are encountered, except perhaps for night conditions, and tend to overstate the actual impacts (ENG-RCAL-028).

As discussed in ENG-RCAL-028, the results in Table 4 can be compared with temporary emergency exposure limits (TEELs) for uranium established by the DOE Subcommittee on Consequence Assessment and Protective Actions, and the DOE Emergency Management Guide calls for the use of TEELs when Emergency Response Planning Guidelines (ERPGs) are not available. Although ERPGs are the standard community exposure limits approved by the American Industrial Hygiene Association, less than 100 chemicals have been assigned ERPGs, and none of those include compounds of uranium. The definitions of the TEEL limits are as follows.

- TEEL-0: The threshold concentration below which most people will experience no appreciable risk of health effects. The TEEL-0 for both uranium metal and uranium oxide (insoluble compound) is 0.05 milligrams per cubic meter.
- TEEL-1: The maximum concentration in air below which it is believed nearly all individuals could be exposed without experiencing other than mild transient health effects or perceiving a clearly defined objectionable odor. The TEEL-1 for both uranium metal and uranium oxide is 0.6 milligrams per cubic meter.
- TEEL-2: The maximum concentration in air below which it is believed nearly all individuals could be exposed without experiencing or developing irreversible or other serious health effects or symptoms that could impair their abilities to take protective action. The TEEL-2 for uranium metal is 2 milligrams per cubic meter and for uranium oxide is 0.6 milligrams per cubic meter.
- TEEL-3: The maximum concentration in air below which it is believed nearly all individuals could be exposed without experiencing or developing life-threatening health effects. The TEEL-3 for both uranium metal and uranium oxide is 10 milligrams per cubic meter.

Based on Table 4 and the definitions of the TEEL limits, the airborne concentration of uranium as a result of the maximum credible accident is about an order of magnitude less for the billets payload than for the powder payload. At distances of 200 meters (656 feet) and greater from an accident involving either payload, the results are either mild transient health effects or nothing at all. At a distance of 100 meters (328 feet), an accident involving powder results in airborne concentration less than TEEL-3. For the billets, the concentration is less than TEEL-1. Only for the very rare weather conditions at 100 meters (328 feet) is the TEEL-3 value exceeded for powder.

Risks associated with offloading activities are similar to those associated with handling any commercially available, bulk solid uranium materials. In the event of an accidental release, potential exposures to the public would be expected to be below those levels that would cause serious health effects.

5.2.3 Potential Disposition of Uranium Materials as Waste

Appendix A provides a discussion of potential impacts associated with a future decision to dispose of unsalable Hanford Site uranium materials onsite, should such a decision be forthcoming. As stated in the Appendix, disposal of up to 140 MTU of uranium materials would be conducted in the 200 Areas of the Hanford Site in existing facilities. Potential accident consequences would be similar to those addressed in current safety documentation for the disposal facilities, and would be bounded by those described previously (Section 5.2.2) for transportation of the materials.

5.3 PROPOSED ACTION: ENVIRONMENTAL JUSTICE

Executive Order 12898, *Federal Actions to Address Environmental Justice in Minority Populations and Low-Income Populations*, directs Federal agencies to identify and address, as appropriate, disproportionately high and adverse human health or environmental effects of their programs and activities on minority and low-income populations. DOE is in the process of developing official guidance for implementation of the Executive Order. However, the analysis in this EA (Sections 5.1 and 5.2) indicates that there would be minimal impacts to both the offsite population and potential workforce during handling and transportation of the uranium materials, under both routine and accident conditions. Additionally, transportation in the continental U.S. would involve established, existing highways, minimizing transit time and associated potential exposure. Therefore, it is not expected that there would be any disproportionately high and adverse impacts to any minority or low-income populations.

5.4 PROPOSED ACTION: CUMULATIVE IMPACTS

The risks associated with routine packaging and transportation of the uranium materials are small. The transportation of the uranium materials would not be expected to substantially contribute to existing worker and public exposure from natural background radiation, or the existing toxicological background environment. As stated previously (Section 5.1.2.2), the average annual radiation dose from natural background radiation to the exposed population between the east coast and the Hanford Site was calculated to be approximately 6,000 person-rem per year. This could be compared with the anticipated calculated additional exposure of less than 10 person-rem associated with the proposed action.

The consolidated storage of Hanford Site uranium materials at Portsmouth Site would be consistent with storage of similar materials. The Portsmouth Site is an active uranium enrichment facility; as such, the total quantity of uranium material fluctuates depending on ongoing enrichment activities. There are approximately 146,000 MTU of uranium materials at the Portsmouth Site.

For perspective, presently there are approximately 1,800 MTU of uranium materials (oxides, fluorides and metal) at the Portsmouth Site Uranium Management Center. The aforementioned inventory of uranium materials was received from DOE's FEMP Site (see Section 2.3.1), with an additional 2,200 MTU of uranium materials projected to be received from the FEMP Site (DOE/EA-1299). It would be expected that the Hanford Site materials would be stored along with the FEMP materials, and represent approximately one-third (in MTU) of the total quantity of uranium materials to be stored at the Uranium Management Center.

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6.0 PERMITS AND REGULATORY REQUIREMENTS

6.1 FACILITY COMPLIANCE

It is DOE policy to carry out its operations in compliance with all applicable federal, state, and local laws and regulations. For example, facilities on the Hanford Site and Oak Ridge-managed facilities, including those locations presently storing surplus uranium materials, operate in compliance with National Ambient Air Quality Standards (*Clean Air Act of 1977*, and U.S. Environmental Protection Agency, 40 CFR 61, "National Emission Standards for Hazardous Air Pollutants"). Hanford Site radioactive stacks have been registered with the Washington State Department of Health (WDOH), Office of Radiation Protection under the Washington Administrative Code (WAC) 246-247, "Radiation Protection, Air Emissions." Operations at Portsmouth Site facilities are conducted under applicable Ohio air emission standards regulations. No air emission permits would be expected to be required for the proposed action.

All generated solid wastes would be handled in a manner compliant with applicable federal and state regulations and DOE Orders. For example, requirements include WAC 173-303 and DOE Order 435.1, "Radioactive Waste Management"*.

6.2 TRANSPORTATION REQUIREMENTS

The loading and transportation of the uranium materials will comply with the applicable regulations, orders, and guidance promulgated by agencies such as the DOE, DOT, and International Atomic Energy Agency (IAEA). These agencies have developed comprehensive regulations covering the performance of the shipping packaging, vehicle safety, routing of shipments, and physical protection. Specific examples include:

- 49 CFR 107, "Hazardous Materials Program Procedures"
- 49 CFR 171, "General Information, Regulations, and Definitions"
- 49 CFR 172, "Hazardous Materials Table and Hazardous Materials Communications Regulations"
- 49 CFR 173, "Shippers-General Requirements for Shipments and Packaging"
- 49 CFR 177, "Carriage by Public Highway"
- 49 CFR 178, "Shipping Container Specifications"
- 49 U.S.C. 1801 et seq, "Hazardous Materials Transportation Act".

* DOE Order 435.1 per projected implementation calendar year 2000.

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7.0 AGENCIES CONSULTED

The Yakama Nation, the Confederated Tribes of the Umatilla Indian Reservation, the Wanapum Band, the Nez Perce Tribe, the States of Washington, Oregon and Tennessee, the Western Governors' Association, the Council of States Governments Midwestern Office, and other stakeholders in Washington State, Tennessee, and corridor states were notified regarding the proposed action. Copies of the draft EA are being distributed to these entities for a 30-day review period.

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8.0 REFERENCES

10 CFR 110, 1993, "Export and Import of Nuclear Equipment and Material," Code of Federal Regulations, as amended.

40 CFR 302, 1993, "Designation, Reportable Quantities, and Notification," Code of Federal Regulations, as amended.

46 CFR 64, 1993, "Marine Portable Tanks and Cargo Handling Systems," Code of Federal Regulations, as amended.

49 CFR 107, 1993, "Hazardous Materials Program Procedures," Code of Federal Regulations, as amended.

49 CFR 171, 1993, "General Information, Regulations, and Definitions," Code of Federal Regulations, as amended.

49 CFR 172, 1993, "Hazardous Materials Tables and Hazardous Materials Communications Regulations," Code of Federal Regulations, as amended.

49 CFR 173, 1993, "Shippers - General Requirements for Shipments and Packagings," Code of Federal Regulations, as amended.

49 CFR 177, 1993, "Carriage by Public Highway," Code of Federal Regulations, as amended.

49 CFR 178, 1993, "Shipping Container Specification," Code of Federal Regulations, as amended.

50 CFR 17, 1992, "Endangered and Threatened Wildlife and Plants," Code of Federal Regulations, as amended.

56 FR 23363, 1991, "Nuclear Regulatory Commission, Preamble to Standards for Protection Against Radiation," Federal Register, May 21.

DOE/EA-0787, *Environmental Assessment for the Shipment of Low Enriched Uranium Billets to the United Kingdom from the Hanford Site, Richland, Washington*, U.S. Department of Energy, Washington, D.C.

DOE/EA-1005, *Environmental Assessment, Disposition and Transportation of Surplus Radioactive Low Specific Activity Nitric Acid, Hanford Site, Richland, Washington*, U.S. Department of Energy, Richland, Washington.

DOE/EA-1123, *Environmental Assessment, Transfer of Normal and Low-Enriched Uranium Billets to the United Kingdom, Hanford Site, Richland, Washington*, U.S. Department of Energy, Richland, Washington.

DOE/EA-1299, *Final Environmental Assessment for the U.S. Department of Energy, Oak Ridge Operations Receipt and Storage of Uranium Materials from the Fernald Environmental Management Project Site*, U.S. Department of Energy, Oak Ridge, Tennessee.

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DOE/EIS-0283-D, *Surplus Plutonium Disposition Draft Environmental Impact Statement*, U.S. Department of Energy, Washington, D.C.

DOE/EIS-0286, *Hanford Site solid Waste (Radioactive and Hazardous) Program EIS*, U.S. Department of Energy, Washington, D.C.

DOT-VNTSC-RSP A-92-1, *National Transportation Statistics, Annual Report for 1992*, U.S. Department of Transportation, Washington, D.C.

Ecology, EPA, and DOE-RL, 1999, *Hanford Federal Facility Agreement and Consent Order*, Washington State Department of Ecology, U.S. Environmental Protection Agency, U.S. Department of Energy, Richland Operations Office, Olympia, Washington.

ENG-RCAL-028, Transportation Risk Assessment for the Shipment of Unirradiated Uranium, Waste Management Northwest, Richland, Washington.

HNF-EP-0918, *Solid Waste Integrated Forecast (SWIFT) Report*, Fluor Daniel Hanford, Inc., Richland, Washington.

SAND89-2370, *RADTRAN 4: Volume 3 -- User Guide*, Sandia National Laboratories, Albuquerque, New Mexico.

PNNL-6415, *Hanford Site National Environmental Policy Act (NEPA) Characterization*, Rev. 11, Pacific Northwest National Laboratory, Richland, Washington.

PNNL-12088, *Hanford Site 1998 Environmental Report*, Pacific Northwest National Laboratory, Richland, Washington.

WHC-CM-4-46, 1988, "Nonreactor Facility Safety Analysis Manual", Westinghouse Hanford Company, Richland, Washington.

APPENDIX A

POTENTIAL WASTE MANAGEMENT OPTION SURPLUS HANFORD SITE URANIUM MATERIALS

It would be expected that, in the event that no marketable value is identified, some materials would be appropriately packaged and transported from current storage locations to the 200 Areas of the Hanford Site for disposal as low-level waste. This activity would be conducted in a manner similar to past on-site disposal of Hanford Site uranium materials. The following is a synopsis of general disposal activities.

Before receipt of waste at the Low-Level Burial Grounds (LLBG), solid waste is characterized and designated. The generator is responsible for packaging the waste according to DOT regulations for hazardous materials. Once the shipment is accepted from the transporter, the LLBG personnel select an appropriate landfill disposal trench, depending on the type of radioactivity, dangerous waste designation of the contents, and waste packaging.

A typical method for disposing of some LLW is trench grouting. Generally, waste materials are encased in the trench for stabilization using the following technique: first the trench floor is prepared to receive the encasement. This involves leveling a section of the trench floor and constructing a reinforced concrete slab. Forms and re-bar for two sides of the encasement are erected on the slab. Next the waste, in mostly drums and boxes, is placed on the slab. Solid waste operations can do this with the aid of a forklift. After the waste is placed, forms and re-bar for the remaining two sides of the encasement are erected. A special concrete formulation is next poured over and around the waste inside the forms to encase the waste. This is done in four lifts to prevent floating the waste packages and to prevent too much heat generation in the curing monolith. A re-bar mat is placed in the last lift to add strength for the top of the encasement. The final lift is sloped to allow water to flow off of the encasement. Appropriate monitoring is conducted throughout the duration of the grouting, and post-stabilization.

Currently, on the Hanford Site, most LLW is disposed in the 218-W-5 Burial Ground. The LLW forecasted waste volume for newly generated waste to be disposed in LLBG through 2046 is projected to be approximately 240,000 cubic meters [Solid Waste Integrated Forecast Technical (SWIFT) Report, Rev. 5, HNF-EP-0918]. Should these uranium materials be considered as waste, the approximately 140 metric tons would constitute a waste volume of less than 400 cubic meters (14,100 cubic feet).

Current safety documentation for waste management facilities address potential accident scenarios associated with disposal of LLW. Such accidents include spills and fires. It is expected that no additional safety analyses would be required for disposal of the subject Hanford Site uranium materials.

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